Science Investigations: Investigating Human Biology Teacher's Guide

Grade Level: 6–12	**Curriculum Focus:** Life Science	**Duration:** 10 segments; 89 minutes

Program Description

This library of videos contains 10 segments on the systems of the human body.

- What Is a Scientific Investigation? (10 min.)
- What Are Scientific Measurements? (10 min.)
- The Scientific Method (12 min.)
- How Bones Develop (7 min.)
- Food & Digestion (9 min.)
- The Circulatory System (9 min.)
- Respiration at High Elevations (8 min.)
- How the Body Fights Flu (8 min.)
- A Sense of Sight (9 min.)
- The Genetics of Twins (7 min.)

Lesson Plan

Student Objectives

- Review the major body systems, including those featured in the video.
- Understand that different systems of the body perform unique functions and that the systems work together.
- Work in groups to develop a labeled diagram of one body system.

Materials

- *Science Investigations: Human Biology* video
- Print resources about the human body and its different systems

- Poster board or butcher paper and color pens
- Internet access

Procedures

1. Ask students to list the major organs of the body *(heart, brain, stomach)*. Explain that the body has several systems that work together, and each system has a particular task. For example, the esophagus, stomach, and small intestine are all part of the digestive system.
2. After watching the video, ask the class to identify the body systems featured. Make sure the list includes the following:
    - skeletal system ("How Bones Develop")
    - digestive system ("Food & Digestion")
    - circulatory system ("The Circulatory System")
    - respiratory system ("Respiration at High Elevations")
    - immune system ("How the Body Fights the Flu")
    - nervous system ("A Sense of Sight")
    - reproductive system ("The Genetics of Twins")

    (You may want to explain the body has other systems: muscular, endocrine, urinary, and integumentary.)
3. Divide the class into six groups and assign each group one system above. Explain that the assignment is to learn more about this system and create a diagram highlighting its major organs. Provide appropriate print and online resources and ask students to begin their research by answering the following questions:
    - What is the primary function of this system?
    - What are the major organs or tissues that make up this system?
    - Briefly describe how this system works. (A flow chart may be used.)
    - Does it change as the body matures? If so, how?
    - Explain one way this body system works with another.
    - Share three interesting facts about the system.
4. Next, hand out a poster board or a large piece of butcher paper to each group. Have students draw an outline of a human body. The will use the outline to illustrate and label the major organs and parts of a body system.
5. Have each group present their diagram. The presentations should include the information that students researched.

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students were active in class discussions; diagrams were complete and clearly labeled significant organs of the body system; presentations reflected a strong understanding of the body system and included all the requested information.
- 2 points: Students participated in class discussions; diagrams were adequate and clearly labeled significant organs of the body system; presentations reflected a satisfactory understanding of the body system and included most of the requested information.
- 1 point: Students did not participate in class discussions; diagrams were incomplete and significant organs of the body system were not clearly labeled; presentations reflected a weak understanding of the body system and included little or none of the requested information

Vocabulary

circulatory system

Definition: The system of blood, blood vessels, lymph vessels, and heart concerned with the circulation of the blood and lymph

Context: The heart is at the center of the circulatory system.

digestive system

Definition: The organs (mouth, esophagus, stomach, small and large intestines) through which food travels so that it can be broken down into the nutrients the body needs.

Context: It usually takes about 12 to 24 hours for food to make its way through the digestive system.

immune system

Definition: The body's defense system that fights infections and foreign substances

Context: The body fights disease-causing viruses and bacteria through its immune system.

nervous system

Definition: The brain, spinal cord, and network of nerves that receive messages from inside and outside the body and transmit instructions about how to respond

Context: Sensory organs such as the eyes are part of the nervous system.

respiratory system

Definition: The system that allows breathing; includes the nose, pharynx, trachea, and lungs

Context: High altitudes may have a dangerous effect on the respiratory system.

skeletal system

Definition: The bones (206 in an adult) that give the body support and protect vital organs

Context: The skeletal system is made of bones, joints, and cartilage.

Thematic Units

Help your students evaluate and analyze what they view in the videos with the Essential Questions for each Thematic Unit.

Energy

ESSENTIAL QUESTIONS

- What provides energy to the human body? How?
- What can cause energy to decrease? How does this happen?
- What steps can we take to maximize our energy levels?

SEGMENTS

Food & Digestion

- *Pre-viewing question*
  What does the Food Guide Pyramid look like? Which foods are at the bottom of the pyramid, and which are at the top?
- *Post-viewing question*
  Describe the human digestive process. How does a healthful diet affect this process and boost energy levels?

The Circulatory System

- *Pre-viewing question*
  How does blood move throughout the body? What can restrict its flow?
- *Post-viewing question*
  How can poor diet and inactivity lead to poor cardiovascular health and low energy levels?

Adaptation

ESSENTIAL QUESTIONS

- How does the human body adapt to trauma or illness?
- Which systems in the human body can adapt to changes in environment? How do they adapt?
- What environmental variations affect human bodily systems? To which of these variations does the body most easily adapt?

SEGMENTS

How Bones Develop

- *Pre-viewing question*
  How do bones change as a person ages?

- *Post-viewing question*
  Which properties of the skeleton help it withstand trauma and heal itself?

The Circulatory System

- *Pre-viewing question*
  What makes up the circulatory system?
- *Post-viewing question*
  How does exercise improve the functioning of the circulatory system? What usually happens to an athlete's heart?

Respiration at High Elevations

- *Pre-viewing question*
  What happens to oxygen levels at high altitudes?
- *Post-viewing question*
  What is acclimatization? How does the body adapt to higher altitudes?

How the Body Fights Flu

- *Pre-viewing question*
  What is a pathogen? What are some examples of pathogens that invade the human body?
- *Post-viewing question*
  How does the human immune system defend itself against pathogens? How does it heal itself after a virus attacks?

A Sense of Sight

- *Pre-viewing question*
  Why is light important for vision?
- *Post-viewing question*
  How can humans see in very low light?

Classification

ESSENTIAL QUESTIONS

- What are the systems of the human body? What are the primary roles of each system?
- What makes up the skeletal system? How do the different parts work together to protect against injury?
- Why is knowledge of genetic traits important? How can identifying and classifying genetic traits advance science?

SEGMENTS

How Bones Develop

- *Pre-viewing question*

What are the largest bones in the human body? What are the smallest bones?

- *Post-viewing question*
  In addition to bones, what else makes up the skeleton? How do these materials function?

The Genetics of Twins

- *Pre-viewing question*
  What is the difference between fraternal and identical twins?
- *Post-viewing question*
  Name some genetic traits. Name some traits that are not genetic.

Inquiry

ESSENTIAL QUESTIONS

- What is scientific investigation? How is it used to improve life for humans and other animals?
- Why are the steps of scientific method important? What would happen if one step were omitted?
- Give examples of scientific inquiry and methodology used in the real world.

SEGMENTS

What Is a Scientific Investigation?

- *Pre-viewing question*
  When is scientific inquiry used in the real world? Who uses it?
- *Post-viewing question*
  What are the essential steps of scientific inquiry? Why is each step important?

The Scientific Method

- *Pre-viewing question*
  What is the scientific method?
- *Post-viewing question*
  Describe the scientific method the Wright brothers used to design and build the first flying machine.

The Genetics of Twins

- *Pre-viewing question*
  What is DNA? Do any two people have identical DNA?
- *Post-viewing question*
  What does research on identical twins separated at birth indicate about personality and genes?

Science and Technology

ESSENTIAL QUESTIONS

- What environment, tools, and standards are necessary for productive scientific work?
- Give examples of medical advancements made as a result of scientific research.
- How do science and technology improve understanding about how the human body functions?

SEGMENTS

What Are Scientific Measurements?

- *Pre-viewing question*
  Why is accurate measurement important in science and the real world?
- *Post-viewing question*
  What are some examples where accurate timekeeping and measurement are important? What other scientific measurements must be accurate?

How the Body Fights Flu

- *Pre-viewing question*
  What is the flu? What is a vaccine?
- *Post-viewing question*
  How are flu vaccines developed? What roles do the Centers for Disease Control and Prevention and the U.S. Food and Drug Administration play in this process?

A Sense of Sight

- *Pre-viewing question*
  Give examples of how vision can be impaired.
- *Post-viewing question*
  How do the parts of an eye work so humans can see? How does a bionic eye work.

History

ESSENTIAL QUESTIONS

- What are some outstanding scientific accomplishments of the 20th century?
- How have environmental, technological, and political changes beginning in the 20th century affected scientific endeavors?
- What changes have taken place in aviation since the Wright brothers designed the first flying machine?

SEGMENT

The Scientific Method

- *Pre-viewing question*
  What did Wilbur and Orville Wright accomplish? Were they successful in all their endeavors?
- *Post-viewing question*
  What challenges did the Wright brothers face in designing the first flying machine? What might be a scientifically revolutionary idea to pursue today?

Academic Standards

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K–12 to promote scientific literacy. To view the standards, visit this Web site: http://books.nap.edu/html/nses/html/overview.html#content.

This lesson plan addresses the following science standards:

- Life Science
- Science as Inquiry
- Science and Technology

Mid-continent Research for Education and Learning (McREL)

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit link: http://www.mcrel.org/compendium/browse.asp

This lesson plan addresses the following national standards:

- Science—Life Sciences: Understands the principles of heredity and related concepts, Understands the structure and function of cells and organisms, Understands relationships among organisms and their physical environment, Understands biological evolution and the diversity of life; Nature of Science: Understands the nature of scientific inquiry
- Language Arts—Viewing: Uses viewing skills and strategies to understand and interpret visual media

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Support Materials

Related Lesson Plans

You can find hundreds of lesson plans online at http://www.discoveryschool.com. The following lesson plans work well with the video segments in this library collection.

- **Body Systems** (grades K–5)
  http://school.discovery.com/lessonplans/programs/bodysystems/
- **Common Vaccinations** (grades 6–8)
  http://school.discovery.com/lessonplans/programs/vaccinations/
- **The Eye: Structure and Function** (grades 6–8)
  http://school.discovery.com/lessonplans/programs/eye/
- **Here's to Your Healthy Heart** (grades 6–8)
  http://school.discovery.com/lessonplans/programs/healthyheart/
- **Investigation: Broken Bones** (grades 6–8)
  http://school.discovery.com/lessonplans/programs/brokenbones/
- **Sight and Light** (grades 6–8)
  http://school.discovery.com/lessonplans/programs/seeingthelight/
- **Twins!** (grades 6–8)
  http://school.discovery.com/lessonplans/programs/themysteryoftwins/
- **Body Systems: Surviving Extremes** (grades 9–12)
  http://school.discovery.com/lessonplans/programs/survivingextremes/
- **The Real Bionic Man** (grades 9–12)
  http://school.discovery.com/lessonplans/programs/therealbionicman/

Other Resources

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- http://school.discovery.com/teachingtools/teachingtools.html

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DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

***Play Video*—** This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

***Video Index*—** This video is divided into 10 segments; the total running time (TRT) is noted for each one. Watching all the segments in sequence is identical to watching a video from start to finish. To play a particular one, press Enter on the remote control; on a computer, click once to highlight a title and start the segment.

***Slide Show*—** A visual overview of the video with key imagery to use for discussion or analysis

***Thematic Units*—** This option groups segments by curricular units, indicated by video thumbnail icons. The themes are Energy, Adaptation, Classification, Inquiry, Science and Technology, and History.

***Standards Link*—** Selecting this option displays a single screen that lists the national academic standards the video addresses.

***Teacher Resources*—** This screen gives the technical support number and Web site address.

Video Index

I. What Is a Scientific Investigation? (10 min.)

Scientific investigations involve observing, inferring, predicting, modeling, forming and testing hypotheses, and arriving at conclusions. Forensic science is one discipline that relies on these steps to solve crimes.

II. What Are Scientific Measurements? (10 min.)

Accurate measurement is essential to scientific practice. Measuring time correctly is important in laboratories and the real world. Seafarers and other navigators have long understood accuracy's importance.

III. The Scientific Method (12 min.)

Wilbur and Orville Wright followed a six-step scientific method to design the first flying machine. They identified a need, researched the problem, devised a solution, built a prototype, and redesigned it before they came up with the solution.

IV. How Bones Develop (7 min.)

The bones in the human body give support, allow movement, and protect the internal organs. Bones' hard outer covering and spongy inner layer make the human skeleton strong and lightweight.

V. Food & Digestion (9 min.)

A healthful diet is critical to good digestion and overall health. Eating foods based on the Food Guide Pyramid from the U.S. Department of Agriculture helps improve energy level, fitness, and intellect.

VI. The Circulatory System (9 min.)

As part of the circulatory system, blood transports oxygen, nutrients, and waste products to the proper places in the body. The heart and blood vessels make up the rest of the system; exercising is essential to keep it in healthy working order.

VII. Respiration at High Elevations (8 min.)

The higher the altitude, the lower the oxygen level. Before making a high-altitude ascent, mountain climbers acclimatize their bodies to prevent experiencing the effects of altitude sickness.

VIII. How the Body Fights Flu (8 min.)

The immune system works hard to fend off the flu and other viruses by producing phagocytes to fight incoming pathogens. To create effective vaccines, scientists must understand how the immune system works.

IX. A Sense of Sight (9 min.)

Sight comes from light, which passes through the eye to nerve impulses in the brain. Researchers are looking for breakthroughs to help people with severe vision impairments.

X. The Genetics of Twins (7 min.)

Unlike fraternal twins, identical twins have the same DNA. Scientists study identical twins separated at birth to learn the role of genetics in determining a person's personality.